

**Product Guide**  
September 2008



# IBM System x3655

## Product Overview

A powerful and versatile general purpose server

**Suggested Uses:** *Medium-to-large enterprise with constrained data center environments, SMBs, telcos, finance, and pharmaceuticals, requiring a high-availability rack-optimized server for dynamic web serving, database serving, business intelligence and numeric intensive floating point applications.*

In the world of general-purpose computing, you require more than just speed. The challenge is to maintain high availability while minimizing costs on power and cooling. The low-cost, two-socket, quad-core **IBM System x3655**, incorporating **IBM X-Architecture**<sup>®</sup> features, meets that challenge. The x3655 was designed with entry-priced, quad-core processors; low-cost DDR II memory; and SATA HDDs to reduce total cost of ownership. Equally importantly, it was designed with numerous high-availability, power monitoring, and proactive power-saving features.

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<b>x3655 Images</b>	11	The x3655 offers up to <b>64GB</b> <sup>1</sup> of industry-standard <b>PC2-5300 DDR2</b> memory with optional <b>Chipkill</b> <sup>™2</sup> <b>ECC</b> (Error Checking and Correcting) protection—for outstanding performance and reliability. For even higher levels of availability, the x3655 also offers <b>online hot-spare memory</b> . <b>Dual</b> integrated high-speed <b>Gigabit Ethernet</b> controllers are standard—offering <b>TOE</b> (TCP offload engine) support, <b>load-balancing</b> and <b>failover</b> capabilities. <b>IBM eExtended I/O</b> <sup>™</sup> features high-performance adapter slots ( <b>four PCIe slots</b> , with the option of replacing one PCIe slot with, <b>one PCI-X</b> or <b>one HTX</b> slot).
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<b>Legal Information</b>	17	All models offer a choice of hard disk drives with a variety of internal hard disk and backup drive configurations: up to <b>six 3.5-inch Serial-Attach SCSI (SAS) hot-swap</b> drives with an internal storage capacity of <b>1.8TB</b> <sup>3</sup> , or up to <b>six 3.5-inch Serial ATA (SATA) hot-swap</b> drives ( <b>4.5TB</b> ), or <b>eight 2.5-inch SAS hot-swap</b> drives ( <b>1.17TB</b> ). It also supports an <b>internal tape drive</b> (in place of two of the 3.5-inch drives). The integrated <b>ServeRAID</b> <sup>™</sup> <b>-8k-I SAS</b> (Serial Attach SCSI) controller provides hardware-based <b>RAID-0/1/10</b> support. Additional RAID support, including battery-backed cache, is available via the optional <b>IBM ServeRAID-8k</b> controller, delivering <b>RAID-5/6</b> capability. Up to <b>21</b> x3655 servers can be installed in a single 42U rack, for a total of up to <b>42</b> processors and <b>168</b> processor cores. Optional <b>Advanced Connectivity Technology (ACT)</b> interconnect cabling reduces cable clutter and cost and minimizes installation time when interconnecting many rack-mounted servers.

Standard in the x3655 is an integrated Baseboard Management Controller (BMC) that enables the user to manage and control the server easily—both locally and remotely. This high level of manageability is designed to keep costs down and the system up—even when network usage increases. A **pop-out/drop-down light path diagnostics panel** enables quick servicing of the system if a hardware problem develops. These advanced features help maximize network availability by increasing uptime, as do integrated **RAID**; **Active Memory**<sup>™</sup>; **temperature-**

<sup>1</sup> Maximum memory and disk capacity may require the replacement of standard components with the largest supported component available. **64GB** capacity using **4GB** DIMMs requires a **2-processor** system in order to use all **16** DIMM slots. In a uniprocessor configuration, only **8** total DIMM slots are available; thus a uniprocessor system is limited to **32GB** of RAM (8 x 4GB).

<sup>2</sup> All models require Chipkill-enabled DIMMs for Chipkill protection. The 512MB DIMMs provided standard are *not* Chipkill-enabled.

<sup>3</sup> TB equals 1,000,000,000,000 bytes when referring to hard disk drive capacity. Accessible capacity may be less.

**controlled hot-swap/redundant fans with Calibrated Vectored Cooling™; hot-swap/redundant power, IPMI 2.0 support, including highly secure remote power control and Serial over LAN; as well as text-console redirect over LAN.**

With the inclusion of unique IBM service and support features such as the BMC, light path diagnostics, **IBM Systems Director, IBM Systems Director Active Energy Manager™** (formerly known as IBM PowerExecutive), **IBM ServerGuide™**, and support for the optional **Remote Supervisor Adapter II SlimLine**, the x3655 is designed for superior uptime.

If you need highly manageable, dual-socket/quad-core computing price/performance in a rack-dense 2U package, the x3655 is the ideal system.

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## Selling Features

## Price/Performance

The x3655 offers numerous features to boost performance and reduce product and operating costs:

- Up to **two quad-core** Opteron Model 2300 Series processors with HyperTransport Technology, DirectConnect Architecture, **3MB of L3 cache** and an **integrated memory controller** offer superior performance capable of tackling the toughest jobs. **64-bit extensions** provide the flexibility to run 32-bit and 64-bit applications concurrently.
- **High-throughput DDR2 memory** uses less power than older DDR1 or fully buffered memory.
- Integrated **ServeRAID-8k-I** provides **RAID-0/1/10** support at no extra charge and without consuming a valuable adapter slot. RAID-0 offers improved disk performance via data striping; RAID-1 offers disk mirroring for high availability, and RAID-10 combines the benefits of speed and availability.
- Four **high-speed adapter slots** offer potential investment protection by supporting high-performance adapters, such as Gb Ethernet, Fibre Channel and InfiniBand cards.
- Up to **six 3.5-inch hot-swap SAS or SATA**, or up to **eight 2.5-inch hot-swap SAS** hard disk drives offer high-performance with high availability.
- The integrated **dual Gigabit Ethernet** controllers with **IPMI 2.0** support provide high-speed network communications.
- The TCP Offload Engine (**TOE**) feature offers higher performance for TCP/IP traffic, with less overhead on the system processor. (A no-charge firmware upgrade, available in 4Q/06, is required to enable this hardware feature.)
- A **high degree of device integration**—including SAS, RAID, dual Gigabit Ethernet, systems management and video controllers—lowers costs and frees up valuable adapter slots.

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## Flexibility

The x3655 has the ability to grow with your application requirements, thanks to:

- A choice of quad-core processors with **1.7GHz** clock rate and 79W power draw and **2.1** or **2.3GHz** clock rates and **115W** power draw.
  - Up to **64GB** of high-speed DDR2 system memory (**32GB per processor**).
  - **IBM eXtended I/O**, which provides **four available high-performance** adapter slots (**one x16, two x8, and one x4 PCIe**; optionally a riser card containing *either one PCI-X/133 or one HTX* slot can replace the x16 PCIe riser) in all models.
  - *Hardware-based* support for **RAID-0/1/10** is provided standard via an integrated **ServeRAID-8-I** controller with **32MB** of cache. Installing a **ServeRAID-8k** option upgrades the system to **256MB** of low-cost cache (with optional battery backup) to enable high-performance internal
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- and external hardware RAID support, and allows the x3655 to offer **six** RAID levels: **RAID-0, 1, 10, 1E, 5, and 6**.
- The **seven USB 2.0** ports are up to **40X** faster<sup>4</sup> than older **USB 1.1** ports. This provides speedy access to external HDDs (non-arrayed), optical drives, tape drives, and other USB devices. Two ports are on the front of the unit, four are on the back, and one port is internal. The internal port supports one tape or GoVault EZ backup drive.
  - A choice of up to **four** internal **3.5-inch HDDs and a backup** (internal tape or GoVault) **drive, six 3.5-inch HDDs without** a backup drive, or **eight** internal **2.5-inch HDDs and a backup drive**—depending on the model—offer a variety of storage options. The **3.5-inch** models provide a maximum of **1.8TB** of internal *hot-swap* **SAS** storage (1.2TB with an internal backup drive installed) or **4.5TB** of internal *hot-swap* **SATA** storage (3.0TB with internal backup drive). The **2.5-inch** models support up to **1.17TB** of *hot-swap* **SAS** storage *in addition* to an internal backup drive. Additionally, direct-attach, iSCSI or Fibre Channel-attached storage can be attached using **IBM System Storage** or **TotalStorage** servers.
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<sup>4</sup> Data transfer rates may be less than the maximum possible.

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## Manageability

Powerful systems management features simplify local and remote management of the x3655:

- The x3655 includes a **Baseboard Management Controller (BMC)** to monitor server availability, perform Predictive Failure Analysis, etc., and trigger IBM Systems Director alerts. The BMC enables service personnel to use sophisticated diagnostic tools, such as light path diagnostics and **Serial over LAN**, to resolve problems quickly.
- **IBM Systems Director Active Energy Manager**, an IBM-exclusive, is designed to take advantage of new system power management features, by providing power monitoring, and power capping features.
- Integrated **IPMI 2.0** support alerts IBM Systems Director to anomalous environmental factors, such as voltage and thermal conditions. It also supports **highly secure remote power control** using data encryption.
- **Text Console Redirection** support allows the administrator to remotely view x3655 text messages over Serial or LAN.
- **IBM Systems Director** is provided for proactive systems management. It comes with a portfolio of tools, including *Active Energy Manager*, *Management Processor Assistant*, *RAID Manager*, *Update Assistant*, and *Software Distribution*. In addition, IBM Systems Director offers extended systems management tools for additional server management and increased availability.
- An optional **Remote Supervisor Adapter II SlimLine** provides additional systems management capabilities, including *Web-based out-of-band control*; *virtual floppy and optical drive support*; *Windows "blue screen" error capture*; *LDAP and SSL support*; and *remote redirection of PCI video, text, keyboard and mouse*. It also adds *PFA support for fans*. And it does all this without consuming a valuable adapter slot.

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## Availability and Serviceability

The x3655 provides many features to simplify serviceability and increase system uptime:

- x3655 servers support **Chipkill-enabled** memory DIMMs (1GB or larger capacity). Chipkill memory is up to **16X** better than standard ECC memory at correcting memory errors. This can help reduce downtime caused by memory errors.
  - The x3655 offers selectable **online hot-spare memory** for redundancy in the event of a noncorrectable memory failure
  - **Toolless cover removal** provides easy access to upgrades and serviceable parts. Similarly, the **Remote Supervisor Adapter II SlimLine** and the **ServeRAID-8k** controller can be installed and replaced without tools. This means less time (and therefore less money) spent servicing the server. Also, **hot-swap/redundant HDDs, fans and power supplies**, as well as **online hot-spare** memory, can mean greater system uptime while components are being serviced.
  - The **pop-out/drop-down light path diagnostics panel** and individual light path LEDs quickly lead the technician to failed (or failing) components. This simplifies servicing, speeds up problem resolution and helps improve network availability.
  - **Integrated RAID-1 disk mirroring** and **RAID-10 striped mirrored arrays** enable the server to keep operating in the event of a failure to any one drive. Optional **RAID-5/6** is available
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simply by plugging in the slotless **ServeRAID-8k** controller.

- **IPMI 2.0** supports highly secure remote system power control using data encryption. This allows an administrator to restart a server without having to visit it in person, saving travel time and getting the server back up and running quickly and securely. It also adds new features to those provided by IPMI 1.5, including **VLAN** support, **Serial over LAN**, enhanced authentication and encryption algorithms (**RMCP+**, **SHA-1**, **AES**) and a **firmware firewall**.
  - **Temperature-controlled fans** adjust to compensate for changing thermal characteristics. At the lower speeds they draw less power and suffer less wear. Equally important in a crowded data center, temperature-controlled fans produce less ambient noise in the data center than if they were constantly running at full speed.
  - The **three-year (parts and labor) limited onsite warranty**<sup>5</sup> helps offer peace of mind and greater potential investment protection than a one-year warranty does.
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<sup>5</sup> For terms and conditions or copies of the IBM Statement of Limited Warranty, call 800-772-2227 in the U.S. In Canada call 800-426-2255. Telephone support may be subject to additional charges. For warranties including onsite labor, a technician is sent after IBM attempts to resolve the problem remotely. International warranty service is available in any country in which this product is sold.

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## Key Features

### High-Performance Quad-Core Opteron Processors

The x3655 supports up to two high-performance AMD Opteron processors, allowing you to upgrade to additional processors as business needs dictate. Each CPU supports up to **eight** DIMM slots, providing up to **16** DIMM slots and **64GB** of max memory in a two-processor system and provides an **integrated memory controller** to reduce memory bottlenecks.

The x3655 offers a choice of processor clock rates:

- **115W quad-core** AMD Opteron Model **2352** or **2356** at 2.1 or 2.3GHz (respectively) with 64-bit extensions, **2MB** (4x512KB) of L2 processor cache (**512KB per core**), and **3MB** of shared **L3** cache
- **79W quad-core** AMD Opteron model **2344 HE** operating at 1.7GHz, with 64-bit extensions, *low power draw*, and **2MB** (4x512KB) of L2 processor cache (**512KB per core**), and **3MB** of shared **L3** cache.

The **quad-core Opteron** processors contain **four complete processor cores**. Each processor contains **one 2MB L2 cache (512KB per core)**. The cores appear to software as separate physical processors. The quad-core processors can offer more than double the performance of a same-speed dual-core Opteron processor (depending on workload).

**System power-efficiency** is crucial for businesses looking to increase their computing strength to spread the workload without outgrowing their current data center. With the power-efficient AMD Opteron quad-core processors, increased performance-per-watt improves compute capacity within the same infrastructure space. By replacing old dual-core Opteron-based servers with new x3655 servers using the new power-efficient processors, you can reduce the number of servers needed, with equivalent performance and lower energy requirement. Or, you can nearly double or quadruple the performance in the same space while still saving on power, when implementing a one-to-one server replacement.



**HyperTransport** technology is a high-speed, low-latency, point-to-point link, designed to increase the communication speed between circuits. It eliminates a key bottleneck currently caused by the stepped-down front side bus (FSB) used in other system architectures, by accessing memory at the same speed as the processor. This permits the fastest possible access to CPU and memory. The x3655 incorporates the latest version of HyperTransport technology (3.0), which provides an aggregate bandwidth of up to **41.6GBps**.

The **integrated memory controller** and the L2 cache run at the full processor clock rate.

**AMD PowerNow!** technology with optimized power management dynamically reduces processor power draw based on workload. This can result in a power savings of up to **75%** per processor at CPU idle.

Opteron offers outstanding 32-bit and 64-bit performance. With a 64-bit operating system, Opteron is capable of running both 64-bit and 32-bit applications concurrently.

Go to <http://amd.com> for more information on HyperTransport technology.

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### DDR II ECC Memory with Chipkill Protection

The x3655 supports up to two processors. Each processor has access to 8 DIMM slots. The maximum memory capacity is **64GB** in **16** DIMM slots (**32GB per processor** installed). (**Note:** The first four DIMM slots per processor operate at **667MHz**; if more than four DIMMs are installed on either processor card, the overall memory speed drops to **533MHz**.) The system provides Active Memory™ features, including advanced **Chipkill** memory protection, for **up to 16X** better error correction than standard ECC memory. Chipkill protection is a global setting. (That is, either all processors have Chipkill enabled or none do.)



For increased availability, the x3655 also offers another level of IBM Active Memory protection: **online hot-spare memory**. This feature, too, is enabled on a global basis.

When *online hot-spare memory* is enabled, using single and/or dual-rank DIMMs **one rank** is set aside per branch as online spares in case one of the other ranks fails. *The spare rank must have capacity at least that of the largest active rank*. Up to **60GB per processor** (using 16 dual-rank 4GB DIMMs) of memory is available when the hot-spare feature is active. (The lowest-numbered rank of those with the highest capacity in each branch is used for the hot-spares.) **Note:** This feature requires operating system support.

The x3655 memory operates in **two-way interleaved** mode for increased performance.

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DIMMs must be installed in pairs. Memory is available in kits consisting of *two* **512MB** (non-Chipkill), **1GB**, **2GB** or **4GB** DIMMs.

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## Large HDD Storage Capacity

The x3655 offers a choice of disk storage, supporting up to **six 3.5-inch hot-swap SAS or SATA** drives, or up to **eight 2.5-inch hot-swap SAS** drives:

### 3.5-inch SATA

- **7,200 RPMs** — 80, 160, 250, 500 or **750GB (4.5TB maximum)**

### 3.5-inch SAS

- **10,000 RPMs** — 36.4, 73.4, 146.8 or **300GB (1.8TB)**
- **15,000 RPMs** — 36.4, 73.4 or **146.8GB (880.8GB)**

### 2.5-inch SAS

- **10,000 RPMs** — 36.4, 73.4, or **146.8GB (1.17TB)**

If you need more storage space, terabyte capacities are possible with external direct-attach, iSCSI, and SAN solutions.

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## Backup Devices

The x3655 supports several internal and external backup options. Supported drives include:

- 36/72 GB DDS-5 Tape Drive (SCSI)
  - 80/120 GB GoVault EZ Drive (SATA)
  - 80/160 GB Half High VS160 Tape Drive (SCSI)
  - 400/800 GB LTO-3 Ultrium Tape Drive (external SCSI)
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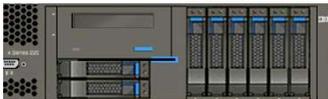
## Drive Bays



The x3655 contains *either seven or ten* drive bays in all, depending on the model. Some models offer **six 3.5-inch** bays that support **hot-swap SAS or SATA** drives. This enables up to six slimline (1.0") drives totaling up to **1.8TB (SAS)** or **4.5TB (SATA)** to be installed.



An internal **half-high DDS5** tape drive or **GoVault EZ** drive can be installed *in place of two* of the HDDs. This offers the confidence of internal tape backup, while still leaving **four** available drive bays (for a total disk capacity of up to **1.2TB** of **SAS** or **3.0TB** of **SATA** storage, respectively).



Other models feature **eight 2.5-inch** bays that support **hot-swap SAS** drives totaling up to **587.2GB**. In *addition* to the eight 2.5" HDD bays, there is a *dedicated bay* for a **half-high DDS5** tape drive or **GoVault EZ** drive.

A **24X/10X/24X/8X<sup>6</sup>** speed (ultraslim, 0.5") CD-RW/DVD-ROM combo drive with an IDE interface ships standard in all x3655 servers. No floppy drive is supplied with any model; an external USB floppy drive may be used, if needed.

For additional storage, a direct-attach, FC SAN, or iSCSI external expansion option can be added, using an optional controller.

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## Disk/Tape Controllers

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<sup>6</sup> Variable read rate. Actual playback speed varies and is often less than the maximum possible.

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All x3655 models include an integrated **SAS** controller. It provides data transfer speeds of up to **300MB** per second<sup>7</sup> in *each* direction (**full-duplex**) across the SAS bus, for an aggregate speed of **600MBps**, nearly double that of Ultra320 SCSI's **320MBps** (half-duplex) bandwidth. The serial design of the SAS bus allows maximum performance to be maintained as additional drives are added.

An integrated *hardware-based* **ServeRAID-8k-I** controller enables **RAID-0/1/10** support and provides **32MB** of PC2-4200 DDR II cache memory. Optionally, a slotless **ServeRAID-8k** controller is available for additional performance (via **256MB** of battery-backed cache) and RAID levels (**RAID-0/1/10/1E/5/6**).

For external storage, the **MegaRAID 8480** controller enables connection to up to **four** IBM System Storage **EXP3000** SAS expansion units (**48** HDDs total). It provides **RAID-0/1/10/5/50** support and **256MB** of onboard cache. Additional external SAS/SATA storage is available using the **external SAS port** on the system unit, or via one of several supported iSCSI or SAN controllers.

The x3655 also includes an IDE controller to support the integrated optical drive. In addition, dedicated *internal* USB and SATA ports are available to support an internal **DDS5** or **DDS6** tape drive or **GoVault EZ Drive** removable disk drive.

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## High-Performance Adapter Slots

The x3655 provides **four high-speed** adapter slots to fit a variety of needs. **Two x8** ("by 8") **4GBps PCIe** slots (Slots **3** and **4**) support **x1/x4/x8** cards at full rated throughput. **One x4** ("by 4") **2GBps PCIe** slot (Slot **2**) supports **x1** and **x4** cards. These slots are **full-length/low-profile**.

In addition, a choice of riser cards supporting **full-length/full-height** adapters adds any one of the following to Slot **1**: **One x16** ("by 16") **8GBps PCIe (PCI Express)** adapter slot (*shipped standard*) supports **x1/x4/x8/x16** cards at full rated throughput. Optionally, *either one PCI-X/133 or one HTX* adapter slot riser can replace the x16 PCIe riser. Throughput for the HTX slot is approximately the same as for the **x16 PCIe** slot, but with even *lower latency*. This slot is ideal for math accelerator and interconnect cards, such as InfiniBand™. The high-performance HTX slot introduces a unique, highly pipelined, cut-through design that, when paired with an HTX adapter, can yield a message rate **10 times** higher than competitive interconnects. As users tackle larger and more complex applications with ever-larger clusters, there is a marked increase in message rates and a decrease in message sizes. The more processors that tackle a given task, the higher the frequency of small, bursty message communications. Thus, interconnect performance has become a key factor and the innovation in IBM HTX adapter slots supporting InfiniBand adapters allows your current applications to run faster and scale higher, helping to improve time-to-solution.

**PCI Express** is a high-performance, low-latency, next-generation serial I/O bus that is rapidly replacing the older parallel PCI and PCI-X buses. A **x16** PCIe adapter offers approximately *eight times* the maximum throughput of a 133MHz PCI-X adapter<sup>8</sup>. (A **x1** adapter offers throughput similar to a 64-bit **66MHz** PCI-X slot.)

Because the **SAS**, **ServeRAID-8k-I** and **8k**, dual **Gigabit Ethernet**, **systems management** and **video** controllers are integrated onto the system board, the adapter slots are all *available*, which offers a wide degree of latitude in expansion options.

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## Dual Gigabit Ethernet Controllers

The x3655 includes **dual** integrated **Broadcom BCM5706** Gigabit Ethernet controllers with **TOE** support<sup>9</sup>, as well as **load-balancing** and **failover** capabilities, with up to 10X higher maximum throughput than a 10/100 Ethernet controller.

**TOE** helps improve overall system performance by offloading TCP/IP protocol processing from the system microprocessor to the onboard Ethernet TOE processor.

The controllers also support highly secure remote power management using **IPMI 2.0**, plus **Wake on LAN®** and **PXE** (Preboot Execution Environment) flash interface. Optional PCI adapters offering failover and load balancing between adapters are available for added throughput and increased system availability.



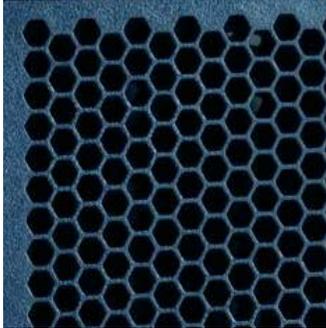
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<sup>7</sup> Data transfer rates depend on many factors and are often less than the maximum possible.

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## Ultra-Efficient Cooling

Strategically located fans, combined with efficient airflow paths, provide highly effective system cooling for the x3655, known as **Calibrated Vected Cooling**. The server includes **five hot-swap** blowers standard. In addition, each power supply contains a fan. **Five additional hot-swap fans** can be installed along with the redundant power supply.



The system contains **four cooling zones**. **Zone 1** (incorporating one fan in a nonredundant configuration or two with redundancy) cools one processor. **Zone 2** (one or two fans) cools some adapter slots and memory DIMMs, **Zone 3** (one or two fans) cools the remaining adapter slots and memory DIMMs, and **Zone 4** (two or four fans) cools the second processor, HDDs, power supplies and system backplane. In addition, each power supply also contains a fan.

The fans automatically adjust speeds in response to changing thermal requirements, from a minimum speed to maximum RPMs, depending on the zone and internal temperatures. When the temperature inside the server increases, the fans speed up to maintain the proper ambient temperature. When the temperature returns to a normal operating level, the fans return to their default speed. Why not simply run the fans at 100% capacity all the time? For several good reasons: to reduce the ambient noise, reduce the wear-and-tear on the fans and reduce the server power draw. The reduction in ambient noise and power draw may be relatively minor for a single server, but put dozens or hundreds in a data center and it can make a big difference!

In addition, the server uses **hexagonal ventilation holes** in the chassis. Hexagonal holes can be grouped more densely than round holes, providing greater airflow through the system cover.

This cooling scheme is important because newer, more powerful processors generate a significant amount of heat, and heat must be controlled for the system to function properly.

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## Hot-Swap/Redundant Components

System availability is maximized through the extensive use of hot-swap and redundant components, including:

- Redundant **memory** protection (with **Chipkill** and/or **online hot-spare** memory enabled)
- Hot-swap, redundant **hard disk drives** (with **RAID-1/10** protection standard and **RAID-1E/5/6** optional)
- Hot-swap, redundant **power supplies** (optional)
- Hot-swap, redundant **cooling fans** (optional)

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## Light Path Diagnostics



Light path diagnostics enables a technician to quickly identify and locate a failed or failing system component, such as a specific fan or memory DIMM. This enables quick replacement of the component, which helps increase server uptime and lower operating costs.

The front of the server has an LED indicator light to show possible component failures. If the front LED indicates an error condition, by pressing a button on the front of the server an LED panel will pop out and drop down for easy viewing without the need to open the server cover or remove the server from the rack. The light path diagnostics panel tells the servicer which component requires attention. In addition, many components have their own identifying LEDs. For example, each of the memory modules has an LED next to the DIMM slot, as do all processors, all adapter slots, all fans, the power supply, the voltage regulator modules and the service processor. This allows the servicer to easily identify exactly which component needs servicing. By following the “light path,” the component can be replaced quickly, and without guesswork. (**Note:** In the event of a failed DIMM or processor, the system will restart and mark the component as bad while offline, thus allowing the system to continue running, with reduced capacity, until serviced.)

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## Other Features

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<sup>8</sup> Actual throughput will depend on the adapter vendor's implementation.

<sup>9</sup> A no-charge firmware upgrade, available in 4Q/06, is required to enable this hardware feature.



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- **Seven USB 2.0 ports** — Provides flexibility to add high-speed external devices. The USB 2.0 specification supports up to 480Mbps transfer rates. (**Note:** Not all USB 2.0 devices are capable of achieving this rate.) Two ports are provided on the front of the server, four are on the back, and one is internal to support a USB-interface tape or GoVault EZ backup drive.
  - **High-resolution video** — An **ATI Radeon ES1000** SVGA video controller provides up to **1280x1024** resolution, with a color depth of **32 bits** at **85Hz** refresh rate, via two video ports (one front, one rear) for convenience.
  - **Remote Supervisor Adapter II SlimLine support** — This optional full-function systems management adapter adds local and remote management functions without consuming an adapter slot.
  - **Internal SATA port** — Provides easy connection of **internal SATA-based backup** storage
  - **Toolless slides** — Allows quick rack installation and quicker upgrade and servicing of the server.
  - **Cable Management Arm** — Simplifies cable management.
  - **Toolless chassis** — The cover can be opened without tools, and many components can be removed and replaced without tools, including the optical drive, PCIe, PCI-X and HTX adapters, as well as the optional RAID controllers. This can save a servicer significant time.

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## Rack Cable Management and KVM Console Switching

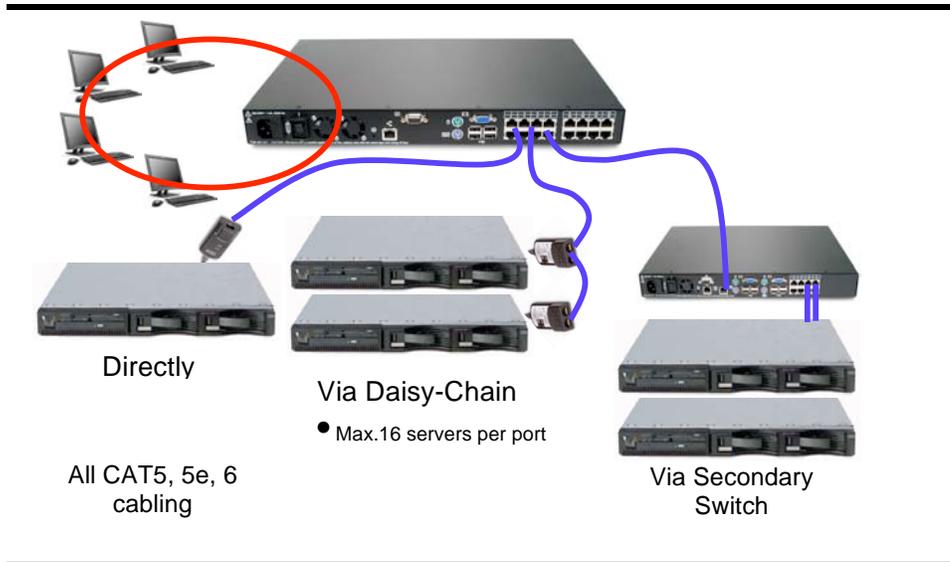
IBM Advanced Cabling Technology (**ACT**) is an optional feature that offers many advantages over standard KVM cabling across the entire System x and xSeries product line. So now you can interconnect all of your servers with one smart cabling architecture. ACT cabling eliminates the need for one-to-one direct connections between each server and a KVM switch by using a daisy-chain approach.



The snarl of cabling behind most racks is at best inconvenient to work around and at worst an expensive logistical nightmare, requiring the rewiring of servers, PDUs, KVM switches, and other equipment whenever a rack server is added or removed. Even worse, the veil of cables blocks rack airflow and can actually contribute to equipment failure due to overheating. ACT cabling is the solution for reducing behind-the-rack cabling by as much as **87%**.

Conventional cabling has bulky KVM cables exiting each server, which then connect to a KVM switch. The cables exiting a series of KVM switches must then be aggregated via additional KVM switches and PDUs, which only increases the number—and cost—of cables, KVM switches and PDUs. Instead, the daisy-chain approach of ACT cabling uses readily available, inexpensive CAT5 and 6 cabling to considerably *reduce* the number of cables, KVM switches, and PDUs needed, rather than increasing them. If a server is removed or added, no complicated rewiring is needed. One cable connects the first server in the rack to the next, and so on. Up to **16** servers form a chain; up to **8** chains can connect to one Local Console Manager (LCM); **16** LCMs can connect to one Global Console Manager (GCM). In this manner, up to **2,048 servers** can be centrally managed. Equally importantly, with ACT—unlike some other offerings—everything is done externally via cabling; *no* special adapters are required.

*The illustration below shows a sample ACT configuration:*



### Advanced Systems Management Capabilities

The x3655 has a high level of systems management capabilities that are well-suited to remote locations as well as to stand-alone environments. Features include the Baseboard Management Controller (BMC), IBM Systems Director Active Energy Manager, Automatic Server Restart, Wake on LAN<sup>®</sup> support, PXE support, text console redirect, Predictive Failure Analysis, IBM Systems Director and support for an optional Remote Supervisor Adapter II SlimLine.

The BMC provides industry-standard **Intelligent Platform Management Interface (IPMI) 2.0**-compliant systems management. It provides a number of important system functions, including:

- Monitoring of system and battery voltage, system temperature, fans, power supplies, processor and DIMM status
- Fan speed control
- Product ID and Family ID detection
- Highly secure remote power on/off
- System reset control
- NMI/SMI detection and generation
- System diagnostic LED control (power, HDD, activity, alerts, heartbeat)
- IPMI over LAN
- Serial Over LAN
- Proxy server support
- LAN messaging and alerting
- Text console redirection over LAN
- VLAN support
- Enhanced authentication and encryption algorithms (RMCP+, SHA-1, AES)
- Local update of BMC firmware
- Firmware firewall

- Support for IPMI v2.0 compliant management software (e.g., xCAT)
- Other mandatory and optional IPMI BMC functions

The BMC alerts IBM Systems Director to anomalous environmental factors, such as voltage and thermal conditions—even if the server has failed.

The x3655 also supports an optional IBM **Remote Supervisor Adapter II SlimLine** for additional systems management capabilities, including:

- Predictive Failure Analysis for system fans
- Graphical console redirection over LAN
- Web-based out-of-band control
- Windows “blue screen” capture
- Remote virtual floppy and CD-ROM
- High-speed remote redirection of PCI video, keyboard and mouse
- SSL (Secure Socket Layer) and LDAP (Lightweight Directory Access Protocol) support

IBM developed **Systems Director Active Energy Manager** to put control of system power-saving features at the fingertips of administrators. Active Energy Manager is designed to take advantage of new features, such as monitoring power usage and balancing the performance of the system according to available power input. It provides the ability to plan and predict power consumption based on your hardware configuration. It also helps enable you to reduce the infrastructure required for redundancy, by using fewer servers on smaller power feeds and potentially lowering your overall data center support costs. It does this by inventorying all components, then adding up the total power draw and tracking the usage.

**Automatic Server Restart (ASR)** helps reduce downtime by restarting the server automatically in the event of a system lockup. ASR technology is a combination of hardware circuitry tied into the server's system reset function and a device driver. As long as the server continues running, the ASR watchdog timer will keep being reset, but if the operating system crashes or the hardware freezes somehow the ASR software will be unable to reset the hardware timer. If the timer is not reset within five minutes, it automatically triggers the ASR hardware, which immediately restarts the server (and logs an ASR event with IBM Systems Director). These features are designed so that *no more than five minutes can pass before the server is restarted*.

**Wake on LAN** permits the server to be remotely powered on if it has been shut off. Once powered up, the server can be controlled across the network, using the **Preboot Execution Environment (PXE)**.

Like Wake on LAN, PXE is system firmware. It enables software such as the optional **IBM Remote Deployment Manager** to take control of a system before the BIOS, operating system or applications are loaded (using Wake on LAN/PXE) and lets an administrator perform many low-level tasks remotely that would otherwise require a visit to each system. These tasks may include such things as formatting a hard disk drive, updating system firmware, or deploying a Windows or Linux operating system.

**Text Console Redirection** support allows the administrator to remotely view x3655 text messages over serial or LAN. An optional upgrade to the slotless **Remote Supervisor Adapter II SlimLine** adds graphical console redirect.

**Predictive Failure Analysis (PFA)** is designed to allow the x3655 to detect impending failure of supported components (processors, memory, voltage regulator modules (VRMs), fans/blowers, power supplies and hard disk drives) *before* actual failure, and alert the administrator through IBM Systems Director. This gives you the ability to replace the failing component *before* it fails, resulting in increased uptime.

**IBM Systems Director** software for advanced workgroup management is included with the x3655. IBM Systems Director comes with a portfolio of tools, including *Management Processor Assistant, Rack Manager, RAID Manager, Update Assistant and Software Distribution*. Active Energy Manager, *System Availability* (a no-charge download) and *Capacity Manager* (sold separately) are available as add-ons for additional server management and increased availability. IBM Systems Director provides a single uniform graphical interface for all of these systems

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management functions.

IBM Systems Director enables you to customize thresholds and monitor system components (for things like temperature, voltage regulation, etc.) to help maximize uptime.

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## Extensive System Support Features

The IBM services and technical support portfolio provides world-class, consistent, high-quality service and support. The x3655 server offers a number of tools and services designed to make ownership a positive experience. From the start, IBM programs make it easier to plan for, configure and purchase System x or xSeries servers, get them running and keep them running long-term. These features include IBM Express Portfolio, IBM ServerProven<sup>®</sup>, the Standalone Solutions Configuration Tool, IBM System x and BladeCenter Power Configurator, IBM ServerGuide, IBM Electronic Service Agent<sup>™</sup>, Product Customization Services and extensive technical support offerings.



This System x server is part of the **IBM Express Portfolio**, designed, developed and priced to meet the specific needs of mid-sized businesses. The IBM Express Portfolio of solutions is easy to acquire, install and manage. And they leverage IBM technology to provide tangible solutions to help you solve business problems in an on demand world.



The IBM **ServerProven** program provides the confidence that specific options and operating systems have been tested on the server and are officially supported to work together. It is updated frequently to ensure that the latest compatibility information is always at your fingertips.

The IBM **Standalone Solutions Configuration Tool** (SSCT) is a downloadable tool that simplifies the often complex chore of configuring a full rack of servers (including blade servers) and confirming that you have all the cables, power distribution units, KVM (keyboard, video and mouse) switch boxes and other components you need, as well as the proper airflow clearances, electrical circuits and other environmental conditions.

**IBM System x and BladeCenter Power Configurator** helps IT managers plan for data center power needs, by providing the following information for specific configurations of System x and BladeCenter systems: *power input* (watts), *PDU sizing* (amps), *heat output* (BTUs), *airflow requirements through chassis* (CFM), *VA rating*, *leakage current* (mA), and *peak inrush current* (amps).

**IBM ServerGuide** (installed from CD) simplifies the process of installing and configuring System x and xSeries servers. ServerGuide goes beyond mere hardware configuration by assisting with the automated installation of the Microsoft<sup>®</sup> Windows<sup>®</sup> Server 2000 and 2003 operating systems, device drivers and other system components, with minimal user intervention. (Drivers are also included for support of Novell NetWare, Red Hat Linux and SUSE LINUX.) This focus on deployment helps you reduce both your total cost of ownership and the complexity that administrators and technical personnel face.

**IBM Electronic Service Agent<sup>™</sup>** is an innovative "call home" feature that allows System x and BladeCenter servers to automatically report hardware problems to IBM support, which can even dispatch onsite service<sup>10</sup> if necessary to those customers entitled to onsite support under the terms of their warranty or an IBM Maintenance Agreement. Electronic Service Agent resides on a server and provides electronic support and problem management capabilities through a highly secure electronic dialogue between your systems and IBM. It monitors networked servers for hardware errors and it can perform hardware and software inventories and report inventory changes to IBM. All information sent to IBM is stored in a highly secure database and used for improved problem determination.

Additional services include hardware warranty upgrades and factory-installed **Product Customization Services** (PCS), such as asset tagging, hardware integration, software imaging and operating systems personalization.

IBM offers extensive **technical support** by phone and via the Web. Support options include links to forums/newsgroups, problem submission, online shopping support, service offerings, device drivers for all IBM product lines, software downloads and even upcoming technical seminar worldwide schedules and registration. Also available are remote installation, configuration and usage support for System x and xSeries hardware and software, as well as onsite custom services to give you the level of expertise you require.

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## Key Options

### IBM options for System x servers help you take your servers to a higher level

You can rely on System x options to supply a complete solution for your business needs. Options help you create an optimized server system to meet your data protection, storage and availability needs. Every IBM option is designed and tested for peak performance and flexibility, helping to maximize your return on investment. The combination of System x servers and options lets you keep your fingers on the pulse of your e-business.

**Processors** — The AMD Opteron processor provides quad cores, 64-bit extensions, a large cache and an integrated memory controller. DirectConnect Architecture reduces memory latency and facilitates the movement of data through the processor and I/O devices. (**Note:** System performance depends not only on the number of processors in the server but also on the power and functionality of each processor.) Adding a second processor may be a cost-effective way to achieve significant performance improvements.

**Memory** — Memory is a significant factor in systems application performance. Adding more memory to a System x server is one of the most effective ways to increase application performance. For best performance in a server with dual-core processors, there should be twice as much memory available as for a single-core processor. A quad-core processor-based server should have twice as much memory as in a dual-core processor-based server. The x3655 takes memory upgrades in pairs and provides two-way interleaving.

**Power Supply/Cooling** — The optional **835W** second power supply for the x3655 enables **redundancy** for hot-swap power. It also enables **redundant cooling** by providing five additional blowers.

**Remote Supervisor Adapter II SlimLine** — The x3655 includes a plethora of systems management features built-in; however, sometimes additional management capability is needed. In those situations, the Remote Supervisor Adapter II SlimLine offers powerful new features, all without consuming a valuable adapter slot.

**Hard Disk Drives** — IBM hard disk drives help you improve the transaction and cost performance of your System x servers. The choice of hard disk drives can be a critical aspect of maximizing the I/O throughput of the system. **3.5-inch SAS** hard disk drives are available for the x3650 with capacities up to **300GB** apiece at **10,000** RPMs; **2.5-inch SAS** drives offer up to **146.8GB** at **15,000** RPMs. **3.5-inch SATA** drives are available with capacities up to **750GB** apiece at **7,200** RPMs.

**Backup Drives** — IBM backup drives help you protect your data. Several choices of capacities (from **36/72GB** to **400/800GB**), technologies (**removable disk cartridge, DDS5, VS160, LTO3**), and interfaces (**SCSI, SATA, USB**) are available.

**ServeRAID Controllers** — System x servers using embedded IBM **ServeRAID** technology allow companies to build a reliable foundation for business-critical computing. ServeRAID technology allows an array consisting of multiple physical hard disk drives to be treated as one logical drive. It also allows data to be stored redundantly, across multiple hard disk drives—enhancing both the integrity and the availability of the data. ServeRAID controllers offer enhanced performance due to onboard processors and cache. Because ServeRAID controllers can help significantly improve data transfer rates, this technology is extremely effective when implementing demanding, transaction-oriented applications. By employing the advanced fault tolerance of ServeRAID technology, companies can effectively implement networked business systems that require large amounts of storage space for data and applications that must be available for their businesses to continue operating.

The optional integrated **ServeRAID-8k SAS** controller offers enhanced performance over the integrated ServeRAID-8k-L controller, **256MB** of battery-backed cache memory, and supports **six** RAID levels: **0** (striping), **1** (mirroring), **10** (mirroring and striping), **1E** (enhanced mirroring, supporting odd numbers of drives), **5** (striping with parity), and **6** (striping with double parity).

External SAN, iSCSI, and direct-attach storage is available using one of several IBM System Storage™ and TotalStorage™ host bus adapters.

The IBM **TotalStorage DS3000, DS4000, DS6000, and DS8000** series, as well as the **System Storage DS4000, N3000, N5000, and N7000** series, comprise a powerful and broad shared storage family with integrated management software designed to meet midrange and enterprise needs. For lower-end needs, IBM offers the TotalStorage **DS400** storage enclosure.

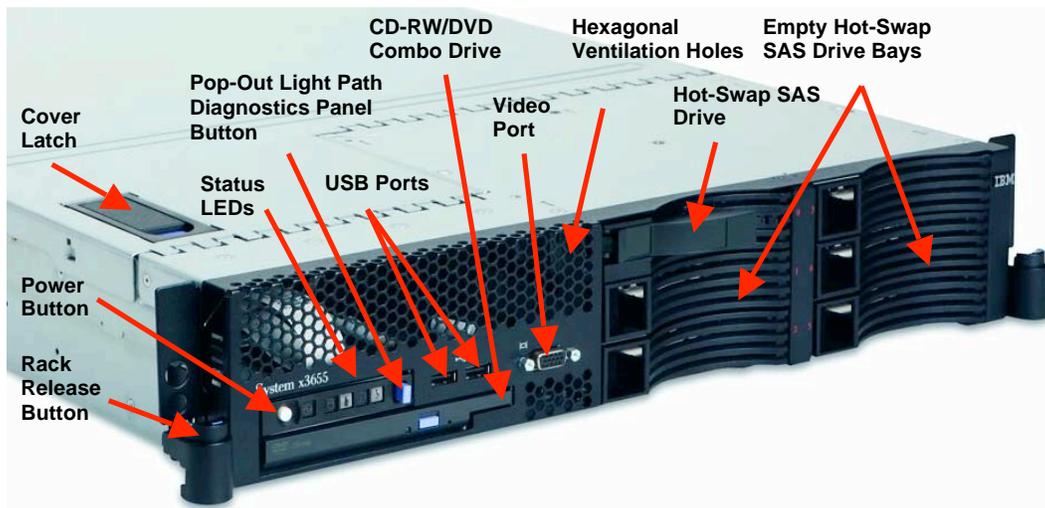
External SAN, iSCSI, and direct-attach storage is available using one of several IBM System Storage and TotalStorage host bus adapters. Additionally, external LAN-attached tape storage is

available.

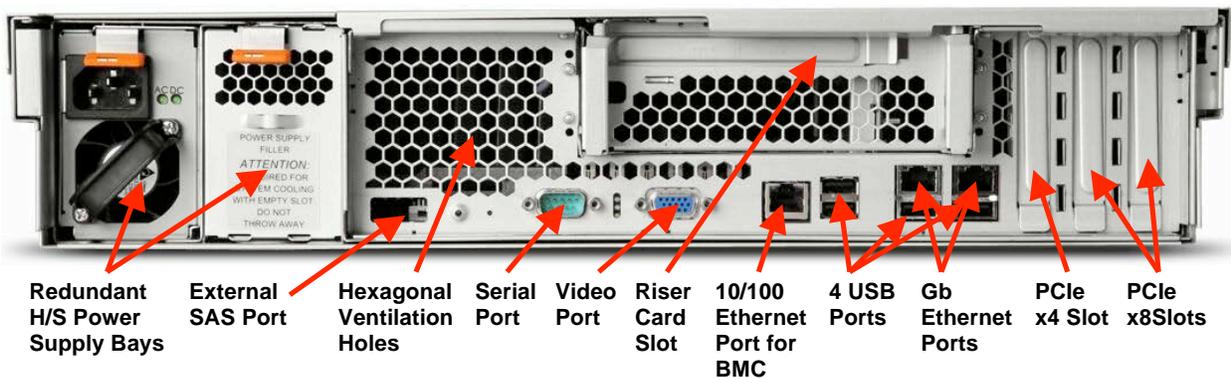
The **iSCSI HBA Adapter for IXA Connectivity** is a PCI adapter for selected System x and xSeries servers that provides a direct **1GBps** link to an IBM System i5 or iSeries server. This connection enables you to centralize their Microsoft Windows and System i5 or iSeries storage and consolidate the operations and backup of their System x, xSeries, System i5 and iSeries systems into a single infrastructure. It enables the tightest possible integration between Windows and System i5/iSeries data and applications, and allows as many as **32** servers to attach to one System i5 or iSeries system to share the iSeries server's systems management, DVD, tape and disk storage via the iSeries dynamic virtual storage architecture. This can take the place of a SAN if you have an established System i5 or iSeries infrastructure.

## x3655 Images

### Front View

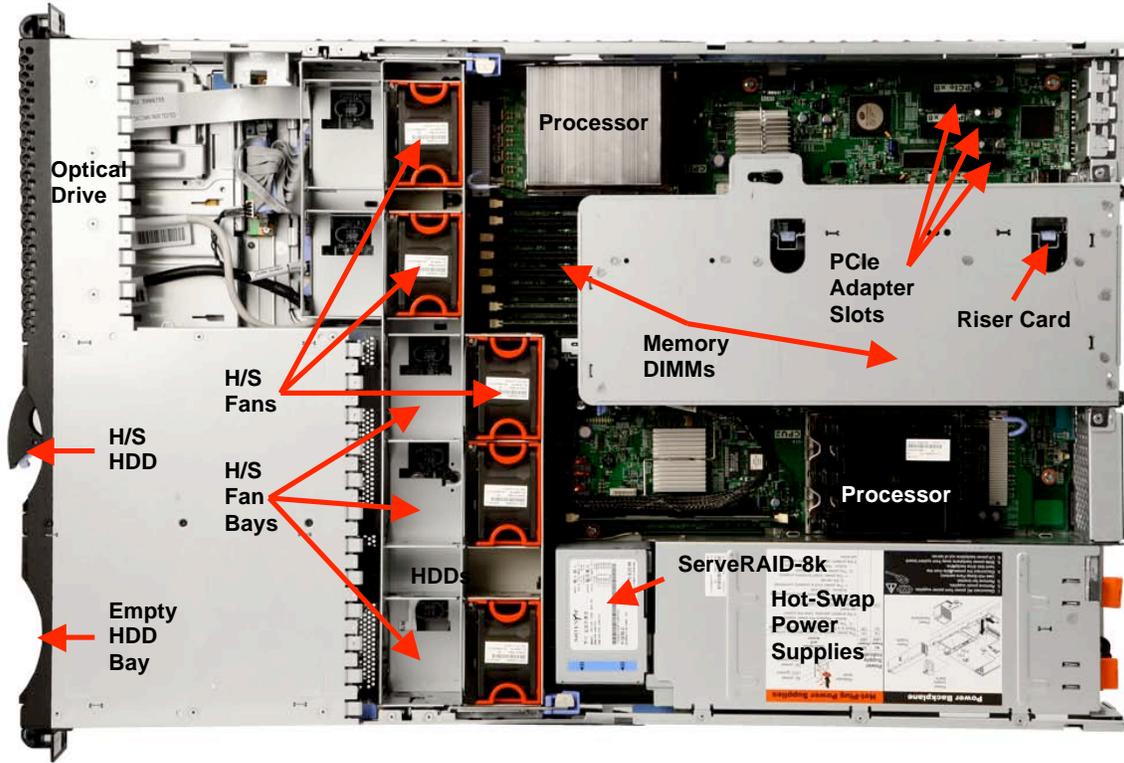


### Rear View



### Interior View

Excellent performance for general-purpose applications at a minimal investment



<b>x3655 Specifications</b>	
<b>Machine type</b>	<b>7943-2xX/2xY, 3xX/3xY, 5xX/5xY</b>
<b>Form factor</b>	<b>2U</b>
<b>Processor type</b>	<b>Quad-core AMD Opteron (2300 Series) 1.7GHz 2344 HE (22X/22Y), 2.1GHz 2352 (32X/322Y, 34X/34Y), 2.3GHz 2356 (52X/52Y)</b>
<b>Maximum processor power draw</b>	<b>79W (22X/22Y)      115W (32X/32Y, 34X/34Y, 52X/52Y)</b>
<b>HyperTransport link speed</b>	<b>1.0GHz</b>
<b># of processors standard / maximum</b>	<b>1 / 2</b>
<b>Maximum processor cores</b>	<b>8 (with two processors)</b>
<b>Internal L2/L3 cache</b>	<b>2MB L2 (512K per core); 3MB shared L3</b>
<b>Chipset</b>	<b>Broadcom HT 1000 / HT 2100</b>
<b>Standard memory<sup>11</sup></b>	<b>2GB (2 x 1GB; Chipkill)</b>

<b>x3655 Specifications</b>			
<b>Maximum memory</b>	<b>64GB</b> with <b>two</b> processors installed; <b>32GB</b> per processor installed (8 DIMMs per processor)		
<b>Standard memory type</b>	PC2-5300 ( <b>667MHz</b> ) registered DDR II ECC, with optional Chipkill protection (using all 1GB-or-larger DIMMs)		
<b>Memory interleaving</b>	Yes (two-way)		
<b>DIMM capacities supported</b>	512MB (not Chipkill-enabled), 1GB, 2GB, 4GB (Chipkill-enabled) <sup>12</sup>		
<b># of DIMM sockets total / available</b>	8 / 6 (one processor)	16 / 14 (two processors)	
<b>Online spare memory supported / # of DIMM sockets reserved for sparing</b>	Yes / 1 DIMM "rank" per processor (2 ranks total)		
<b>Memory mirroring supported / # of DIMM sockets reserved for mirroring</b>	N/A		
<b># of drive bays total / available</b>	<b>7 / 6</b> 3.5-inch (optical drive installed)— 22X/22Y, 34X/34Y	<b>9 / 8</b> 2.5-inch (optical drive installed)— 32X/32, 52X/52Y	
<b># of HDD drive bays total / available</b>	<b>6 / 6</b> 3.5-inch ( <b>without</b> tape installed)—22X/22Y, 34X/34Y	<b>6 / 4</b> 3.5-inch ( <b>with</b> tape installed)—22X/22Y, 34X/34Y	<b>8 / 8</b> 2.5-inch ( <b>with</b> or <b>without</b> tape installed)—32X/32Y, 52X/52Y
<b># of 5.25" bays total / available</b>	1 / 0 (optical drive installed)		
<b>Maximum HDD capacity</b>	<b>1.8TB</b> (6 x 300GB) <i>hot-swap SAS</i> 3.5-inch ( <b>without</b> internal backup installed); <b>1.2TB</b> (4 x 300GB) <i>hot-swap SAS</i> 3.5-inch ( <b>with</b> internal backup installed)—22X/22Y, 34X/34Y	<b>4.5TB</b> (6 x 750GB) <i>hot-swap SATA</i> 3.5-inch ( <b>without</b> internal backup installed); <b>3.0TB</b> (4 x 750GB) <i>hot-swap SATA</i> 3.5-inch ( <b>with</b> internal backup installed)—22X/22Y, 34X/34Y	<b>1.17TB</b> (8 x 146.8GB) <i>hot-swap SAS</i> 2.5-inch ( <b>with</b> or <b>without</b> internal backup installed)—32X/32Y, 52X/52Y
<b>HDD capacities supported</b>	<u>3.5-inch SAS</u> 73.4, 146.8, <b>300GB</b> — <b>10K</b> RPMs; 36.4, 73.4, <b>146.8GB</b> — <b>15K</b> RPMs	<u>3.5-inch SATA</u> 80, 160, 250, 500, <b>750GB</b> — <b>7,200</b> RPMs;	<u>2.5-inch SAS</u> 36.4, <b>146.8GB</b> — <b>10K</b> RPMs
<b># of HDDs standard</b>	None		
<b># of optical drives standard</b>	1 <b>CD-RW/DVD-ROM Combo</b> (48X/32X/48X/16X, in dedicated 5.25" bay)—IDE-attach		
<b># of diskette drives standard</b>	None (external USB-attach)		
<b>Internal backup devices drives supported</b>	<b>GoVault EZ Drive</b> (USB 2.0 or SATA-attach) <b>DDS-5</b> or <b>VS160 (SCSI)</b> —uses <b>two drive bays</b> on 3.5-inch models; <b>dedicated bay</b> on 2.5-inch models		

Excellent performance for general-purpose applications at a minimal investment

<b>x3655 Specifications</b>	
<b>Disk drive technology</b>	Hot-swap SAS/SATA
<b>Integrated disk controller</b>	Eight-port Adaptec 9580W SAS/SATA
<b># of disk drives supported <i>per port</i></b>	1
<b>External disk drives supported</b>	Yes, via external 4-port SAS connector
<b>Integrated RAID controller / cache</b>	ServeRAID-8k-I (32MB cache, 400MHz DDR2) standard—internal SAS/SATA
<b>Optional RAID controllers supported</b>	ServeRAID-8k (256MB, 400MHz DDR2)—internal SAS/SATA
<b># of adapter slots total / available</b>	4 / 4
<b># of PCIe x16 slots (8GBps)</b>	1 (standard; on riser) <b>full-height/full-length</b>
<b># of PCIe x8 slots (4GBps)</b>	2 (standard) <b>low-profile/full-length</b>
<b># of PCIe x4 slots (2GBps)</b>	1 (standard) <b>low-profile/full-length</b>
<b># of HTX slots (8GBps, low latency)</b>	<b>None</b> (1 optional; replaces the x16 riser) <b>full-height/full-length</b>
<b># of PCI-X/133 slots (1GBps)</b>	<b>None</b> (1 optional; replaces the x16 riser) <b>full-height/full-length</b>
<b># of video ports</b>	2 (1 front, 1 rear)
<b>Video controller</b>	ATI Radeon ES1000
<b>Video memory</b>	32MB DDR1 SDRAM
<b>Maximum video resolution at 32-bit color</b>	1280 x 1024 x 32-bit color at 85Hz
<b>Gigabit Ethernet controllers</b>	2 Broadcom BCM5706
<b>TOE / failover / load-balancing-capable</b>	Yes / Yes / Yes
<b># of Gigabit Ethernet ports</b>	2 (rear)
<b># of RS485 ports</b>	None
<b># of serial ports</b>	1 (rear); shared with BMC
<b># of parallel ports</b>	None (USB-attached)
<b># of mouse ports</b>	None (USB-attached)
<b># of keyboard ports</b>	None (USB-attached)

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<b>x3655 Specifications</b>		
<b># of USB 2.0 ports</b>	6 (2 front, 4 rear)	
<b>Integrated systems management controller</b>	Yes (BMC)	
<b>Optional systems management adapter</b>	Remote Supervisor Adapter II SlimLine	
<b>Light path diagnostics support</b>	Yes	
<b>Predictive Failure Analysis support</b>	Processors, memory, voltage regulators (VRDs), HDDs, power supplies and fans	
<b>Power supply size</b>	835W universal, autoswitching, hot-swap	
<b># of power supplies standard / maximum</b>	1 / 2	
<b>Hot-swap/redundant power supported</b>	Yes	
<b># of fans/blowers standard / maximum</b>	5 / 10 fans (plus one fan per power supply)	
<b>Hot-swap/redundant fans supported</b>	Yes	
<b>Heat emitted: maximum BTUs</b>	89 (min.) – 3,225 (max.)	
<b>Rack mount method</b>	Toolless rails and Cable Management Arm (provided standard)	
<b>Maximum altitude</b>	7,000 ft; 2,133 m	
<b>Operating temperature range</b>	50 – 95° F; 10 – 35° C (up to 3,000 ft / 914.4 m)	50 – 90° F; 10 – 32° C (3,000 ft to 7,000 ft / 914.4m to 2,133m)
<b>Dimensions (HWD) / weight</b>	3.37" (85.4mm) <b>H</b> 17.5" (444mm) <b>W</b> 27.5" (698mm) <b>D</b>	<b>65 lb</b> (maximum) <b>29.5 kg</b>
<b>Operating systems supported</b>	Microsoft Windows Server 2003 R2 (Standard/Web/Enterprise/SBS Editions) 32/64-bit, RHEL 3/4 AS/ES/WS 32/64-bit, SLES 9/10 Enterprise Server 32/64-bit, Novell NetWare 5.1/6.5, SCO UnixWare 7.1.4, VMware ESX Server 2.5.4/3.0	
<b>Length of limited warranty</b>	3 years (parts and labor) <sup>13</sup>	

***The Bottom Line***

The x3655 is an extremely powerful system that incorporates leading-edge industry-standard features and adds IBM-unique innovations:

**Performance**

- **High-throughput processors** — 1.7GHz to 2.3GHz quad-core Opteron 23xx series processors
- **Large cache** — 2MB of L2 cache; 3MB of L3 cache
- **64-bit extensions**
- **HyperTransport Technology** — High-speed (1GHz) access between processors, memory and I/O controllers
- **Fast memory** — 667MHz PC2-5300 DDR II ECC memory standard (even with 8 DIMMs populated per processor), **low latency**, and **two-way interleaving**
- **Fast disk technology** — Integrated **ServeRAID-8k-I full-duplex SAS** controller with **32MB** of cache memory; upgradeable to an integrated **ServeRAID-8k** SAS controller with **256MB** of **battery-backed** cache
- **Fast communications** — Integrated **dual Gigabit Ethernet** controllers with **TOE, failover** and **load-balancing** support
- **Fast I/O** — **Four** high-performance adapter slots

#### **Flexibility**

- **Large memory capacity** — Up to **64GB**, using **16** DIMMs (in a two-processor system)
- Up to **six 3.5-inch hot-swap SAS** or **SATA** drives or **eight 2.5-inch hot-swap SAS** drives, and support for external iSCSI/FC SANs
- **High-capacity disk storage** — Up to **1.8TB** of internal **hot-swap SAS** or **4.5TB** of **hot-swap SATA** storage using **3.5-inch** drives; up to **1.17TB** of internal **hot-swap SAS** storage using **2.5-inch** drives
- Support for an **optional half-height internal backup drive** (in place of two 3.5-inch HDDs, or *in addition* to eight 2.5-inch HDDs); choice of **removable disk cartridge** (GoVault EZ), **DDS-5** tape, or **VS160** tape
- **High-performance external expansion** — **Seven** 480Mbps **USB 2.0** ports (two front, four rear, one internal)
- Optional high-performance RAID controllers for internal or external drives
- **Four available** adapter slots —
  - **Two x8<sup>14</sup> PCIe** slot (4GBps) *and*
  - **One x4<sup>15</sup> PCIe** slot (2GBps); *plus either:*
    - **One HTX** slot (8GBps, low latency) *or*
    - **One x16<sup>16</sup> PCIe** slot (8GBps) *or*
    - **One PCI-X/133** slot (1GBps)
- Integrated **CD-RW/DVD-ROM Combo** drive
- Optional **iSCSI HBA Adapter for IXA Connectivity** (to System i™/iSeries™ servers)

#### **Manageability, Serviceability and Availability**

- **IBM Systems Director** systems management software, including:
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- IBM Systems Director Active Energy Manager
  - IBM Management Processor Assistant
  - IBM Rack Manager
  - IBM RAID Manager
  - IBM Update Assistant
  - IBM Software Distribution
  - IBM System Availability
  - **Integrated Baseboard Management Controller (BMC):**
    - IPMI 2.0** compliance, including highly secure remote power control
    - Text console redirection** systems management standard
  - **Active Memory protection:**
    - Advanced **Chipkill** ECC memory protection, and
    - Online hot-spare memory**
  - Slotless hardware-based **RAID-1** disk mirroring and **RAID-10** striped/mirrored arrays standard; optional slotless **RAID-1E/5/6** highly available arrays
  - **Ultra-efficient cooling** incorporating **Calibrated Vektored Cooling** features
  - **Hot-swap hard disk drives**
  - Optional **hot-swap/redundant power supplies** and **cooling**
  - **Light path diagnostics** (front LED panel, drop-down light path panel)
  - Optional **Remote Supervisor Adapter II SlimLine** daughter card (no slot required)
    - Supports **LDAP** and **SSL** industry standards
  - **Toolless chassis** and **toolless slide** design; integrated **Cable Management Arm**
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## For More Information

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